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ABSTRACT

Data are presented from a long-term follow-up study investigating the interplay of various factors contributing to the developmental outcome of prematurely born children. Fifty-eight low-risk pre-term Hungarian children are compared to 100 full-term children, from birth to age 6, on socioeconomic status, family climate, and intellectual stimulation. Maternal attitudes are analyzed in terms of perfectionism, over-permissiveness, over-protectiveness, rejecting/neglecting, predictability, and authoritarian/democratic elements. The evidence indicates that perinatal risk conditions such as preterm birth have a differential impact on mental development depending upon social-environmental factors. Advantaged family circumstances may reduce or even fully compensate for the adverse effects of perinatal risks, while a disadvantaged environment is likely to amplify them. Includes 59 references. (JDD)

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THE ROLE OF PARENTAL ATTITUDES AND THE QUALITY OF THE HOME LEARNING ENVIRONMENT IN THE MENTAL DEVELOPMENT OF PREMATURELY BORN CHILDREN

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Premature birth is one of the most common biological risk factors threatening the early life and development of a child. The literature about the later outcome of preterm birth is rather controversial. Several follow-up studies have revealed a high incidence of deficits in mental development - ranging from mild to severe handicaps - in groups of children born prematurely. In contrast, a number of researchers have reported data suggesting that on the whole the mental growth of preterm children is comparable with that of their non-risk peers.

Prematurity by no means represents a homogeneous condition, therefore its long-term effects depend on a number of other variables. In some of the recent studies a great number of potentially relevant perinatal variables have been taken into account - such as birth weight, and whether or not (and to what extent) the infant was sick at birth, etc. The results based upon very refined perinatal risk scales (e.g. Parmelee's Obstetric and Postnatal Complication Scales), however, still leave part of the contradiction unsolved: the predictive power of even these multiple criteria appears to be relatively short-lived, that is, it rarely goes beyond a few years.

It has become clear by now that the existence of a biological risk condition does not permit any direct prediction of developmental outcome. Considering the extensive literature on the determinants of mental growth in normal children it is very natural to expect that, besides the perinatal risk status, the social situation of the family also contributes to the development of mental abilities in preterm children.

The impact of social factors, however, is not simple. First of all, one must be aware of the fact that the birth risks are frequently associated with poor social circumstances. This implies that if in a particular study it has not been taken into account that the incidence rates of premature birth in higher and lower social strata are different, low SES is likely to be overrepresented in the preterm sample when compared to a randomly selected control group of full-term children.

(Presented at the symposium on "Child and Different Structures and Interpersonal Relationships of Recent Family Types", Lahti, Finland, 1989.

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This in itself could account for a poorer average performance of the preterm group. In some recently published studies the possibility of such a methodological shortcoming has been ruled out by using control samples matched for SES. It seems, however, that this alone cannot explain the inconsistency of findings: in order to understand the diverse pathways of mental growth in children born at biological risk the inclusion of environmental variables in the analysis is indispensable. Large-scale longitudinal projects have provided convincing evidence that environment has the power to reduce or amplify the developmental problems related to prematurity and other perinatal complications (Caputo et al, 1981; Hunt, 1981; Sigman et al, 1981; Wallace & McCarton, 1985). The majority of children with good socioeconomic background, even if they were quite high-risk at birth and developmentally delayed in early infancy, gradually "catch up", while those from socially disadvantaged families do not (Drillien, 1964; Drillien et al, 1980; Werner et al, 1971, 1978, 1982).

Over the last two decades more and more researchers interested in the mechanisms of mental development have realised that the SES of the family alone, however powerful, is not a sufficient indicator of the quality of a child's home learning environment.

As Deutsch (1973) warned, if any relationship between SES and behaviour is found, it should be interpreted only as a first step of an investigation aiming to clarify the processes underlying the relationship. A number of authors (e.g. Dave as well as Wolf, both cited by Elardo and Bradley, 1981; Hanson, 1975; Henderson et al, 1972; White & Carew, 1973; Yarrow et al, 1973) have reported positive correlations between the children's mental growth and features of the home environment like intellectual interests and activities in the home, stimulation provided to explore the environment, provision of opportunities for learning, parental involvement with the child, intensity of communication, achievement press, valuing language and school-related behaviour.

Although, as Sigel et al. (1984) note, it is certainly difficult to identify one particular aspect of parental behaviour that promotes children's intellectual capacity, in the past years some remarkable findings have been published in this respect. In a longitudinal study of Ramey et al. (1979) the mothers' behaviours and attitudes could account for more than half of the variablity in 3-year-olds' IQs. Sigel (1982) has found that the use of distancing teaching strategies by parents is correlated with their children's intellectual performance.

Caldwell and her associates designed an instrument called the "Home Observation for Measurement of the Environment" to assess systematically a broad array of transactions, events, and objects in the child's environment, regarded as potentially important for development (Caldwell & Bradley, 1984, 1985). This research team in a series of reports present evidence of the relationship between the child's intellectual status and environmental variables such as provision of appropriate play materials, organisation of physical and temporal environment, opportunities for variety and daily stimulation, and mother-infant interaction (Bradley and Caldwell, 1976; Elardo et al, 1975, 1977). In the longitudinal studies of Caldwell and her associates "the setting as a structured environment" model (Bronfenbrenner & Crouter, 1983) is implied.

So far not too many investigators studying preterm children have attempted to go beyond the use of SES in classifying the families to detect the "home environmental processes" (Deutsch, 1973). The Los Angeles follow-up study provided evidence of the influence of the caregiver-infant interaction as well as of the language background (Sigman et al, 1981) and in the same project Sigman and Parmelee (1979) suceeded in validating a cumulative risk score by the inclusion of some caregiver-infant interaction measures. Pederson et al. (1986) found the degree of maturity and responsiveness of maternal behaviour to be a significant component of the developmental progress in low-birthweight infants.

Among the increasing number of projects employing the HOME inventory to assess these "home environmental processes" recently there are a few which involve prematurely born children. Bradley et al. (1987) reported that several HOME subscales covering social and physical stimulation were significantly correlated with the developmental status of preterm infants. Furthermore, Siegel (1982) as well as Smith et al. (1982) have demonstrated that such HOME factors could account for those cases which have turned out to be false positives in the prediction from perinatal risk conditions to early childhood outcome. Our follow-up of a group of preterm children (different from the target sample of the present study) to school-age yielded similar results: a home environmental process-variable labelled as "intellectual fostering" predicted scholastic achievement and the level of a variety of related abilities better than SES (Kalmár, 1988).

The data to be reported in the present paper are part of a long-term follow-up study aimed to investigate the interplay of various factors contributing to the developmental outcome in prematurely born children.

METHOD

Subjects

Our target sample (n=58; male:26, female:32) was recruited from among relatively low-risk pre-term children, since it has been one of the objectives of the study to detect the later effect of premature birth itself, not confounded, as far as possible, by any other biological risk factors. The gestational age ranged between 29-37 weeks (mean: 34 weeks); birth weight between 1050-2450 grams (mean: 1771 grams).
The control group consists of 100 full-term, healthy born children (male:53, female:47).

Measures

Biological variables: pre-natal history, gestational age, birth weight, and perinatal risk index (for the preterm group only).

Environmental (family) variables: SES - as scored at the time of birth (SES1) and at the 6-year follow-up (SES2), family climate, intellectual stimulation, and parental attitudes.

Outcome measures:
- Up to 3 years of age: the ages at which the milestones of the psychomotor development were achieved;
- From 3 years onwards: IQ tests, visual-motor and attention tests.
- Teacher rating scale of school adaptation and progress.

The families (at least the mother-child dyads) were seen once in every three months during the first year, then twice a year until the third birthday of the child, since then the follow-ups have taken place around each birthday. The study is still in progress; so far the data gathered up to the 6th birthday of the children have been processed. In the analysis to be presented here only the Budapest-Binet IQ scores are used as outcome measures.

Most of the information on environmental quality presented and discussed by the studies referred to in the introductory part of this paper was obtained through interview technique. Caldwell's opinion is that interviews are generally not adequate to assess some important parent behaviours (Caldwell & Bradley, 1989); therefore the HOME inventory involves a combination of observation and interview techniques.

In the interpretation of the personal and physical aspects of the environment we adopted the "setting as a structured environment" model (Bronfenbrenner & Crouter, 1983) which is implied in the HOME inventory. Yet the present paper is not based on HOME factor scores. When working with the full-term sample we had no opportunity to administer the full HOME inventory. With the preterm group we are using the elementary school-age version of the HOME scale. As the children constituting the sample were born four years apart, they are gradually coming to school age, thus to date HOME scores have been available for a certain portion of the sample only (therefore these scores are not included in the analysis).

We fully agree with Caldwell's criticism of the exclusive use of interviews and in designing our project we had in mind her claim for the advantage of combining it with observation. Therefore, a combination of observation and interview techniques has been used from the first encounter with the families, throughout the follow-ups. Items and categories for conducting the observations and interviews as well as for analysing the data were drawn from the Fels Parental Behavior Rating Scale (Baldwin et al, 1945), the interview on child rearing by Sears, Maccoby & Lewin (1957), the Parent Attitude Research Instrument ((Schaefer & Bell), the Family Environment Scale (Moos, 1974), and the HOME inventory (Caldwell & Bradley, 1984, 1985).

The shortcoming of not possessing data on all aspects covered by the full HOME inventory may in part be compensated by the advantage of having regular, long term contact with the families, in contrast to the "single-observation" nature of the usual administration of the HOME scale.

In order to perform statistical analysis, the observational and interview data were transformed into scores allocated on rating scales covering two important dimensions of the quality of the home environment. In the present analysis information pertaining to the age period beyond infancy (up to 6 years) has been included. One of the scales yields a composite measure called "family climate", which, besides the quality of the general emotional climate, covers aspects like demands, control, encouragement of competence, and intensity of communication. The other scale attempts to capture more specifically th "intellectual stimulation" provided for the child.

In addition to scoring the family climate and the intellectual stimulation, each mother's attitude towards the child was assigned to one of 8 patterns. The categories were set up after the models of maternal behaviour by Becker (1964), Lamb and Baumrind (1978), and Schaefer (1959). In addition to the dimensions of acceptance - rejection and permissiveness - restrictiveness aspects like support, protection, the types of demands, the types of punishment, and the consistency and predictability of the mother's behaviour were taken into consideration. The final list of categories was decided upon after a preliminary analysis of the records of interviews and observations. The items of the "family climate" scale and the elements constituting the patterns of maternal attitudes overlap, but while the "family climate" scale yields scores, i.e. a quantitative index, the use of the categories of maternal attitudes has been meant to serve a descriptive qualitative analysis.

F I N D I N G S

Comparison of the samples on the basic measures +

In SES there is no difference between the preterm and the fullterm sample (the mean scores are practically the same and the SDs are also very similar) although the groups were not selected initially on purpose as samples matched for SES.

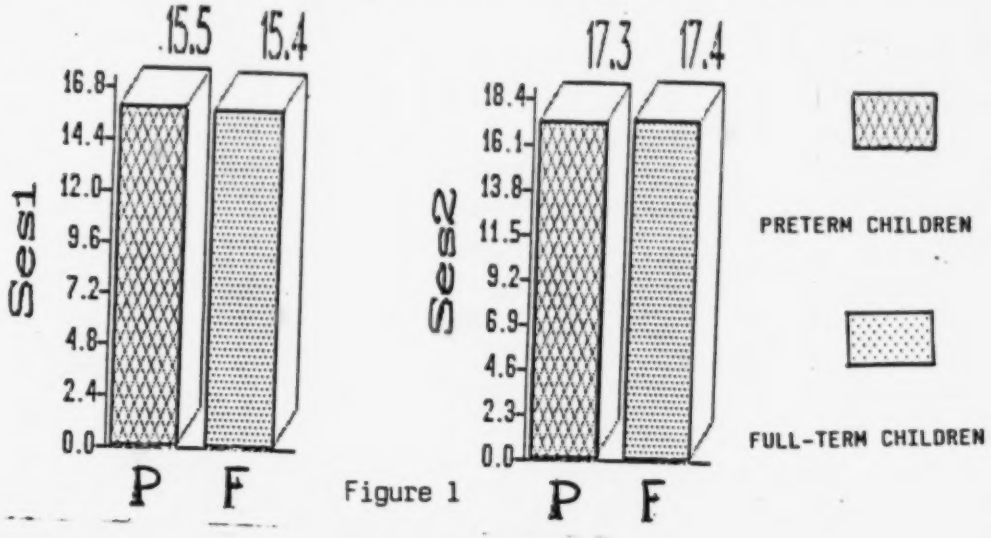

Figure 1

+ The statistical comparisons were performed using ANOVA.

Naturally it cannot be inferred from this that in Hungary the incidence of premature birth should be independent from social circumstances. The willingness for cooperation on the part of the family which was indispensable for the inclusion in the study is very likely to have had a strong selective effect on the composition of the samples, mainly in that the very chaotic, deviant families of the lowest socio-economical level are missing or at least very much underrepresented.

Even in this socially non-representative preterm sample there are, however, some trends related to SES that may be worth mentioning.

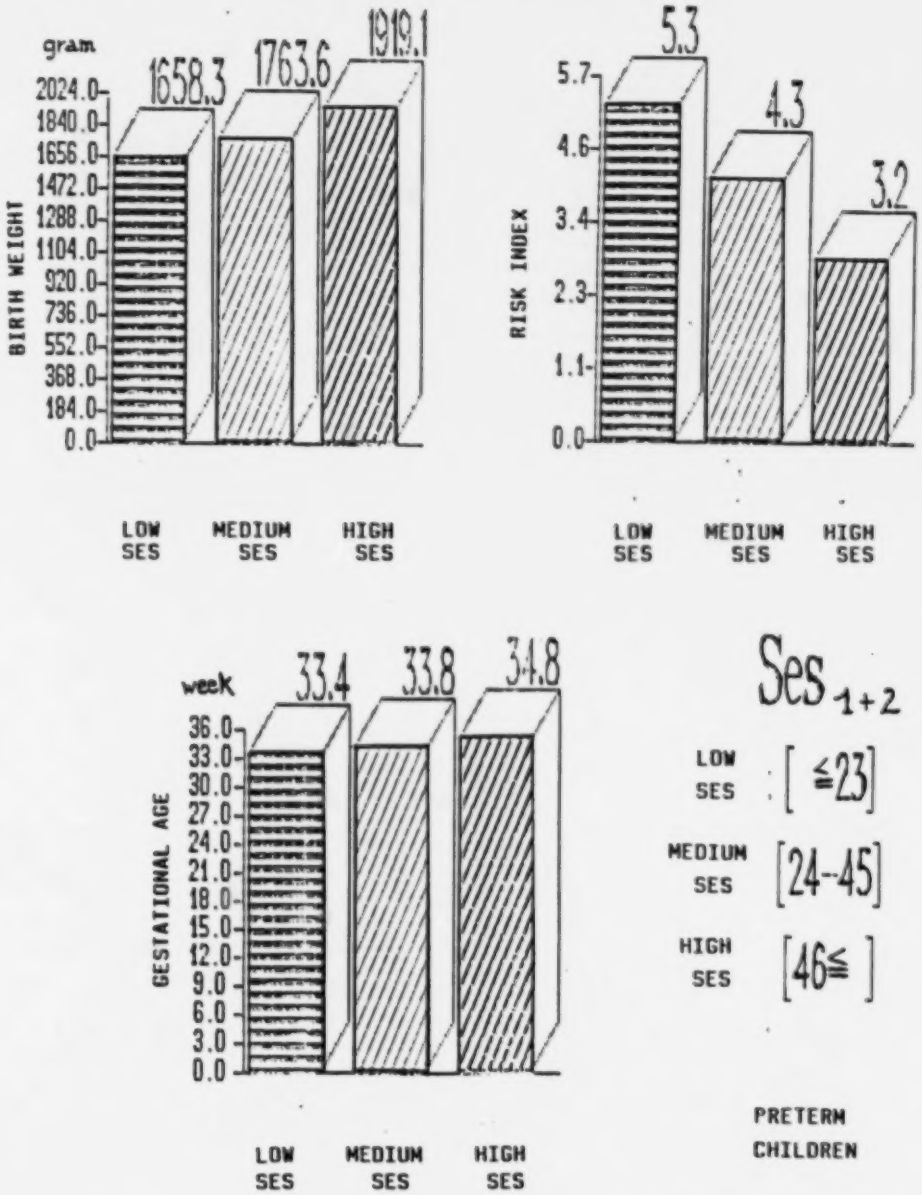

Figure 2

At the lowest socio-economical level the average birth-weight is lower, at the highest socio-economical level it is higher than the average of the total group, although the correlation between these two variables is not significant. The breakdown of the means of the risk-index indicates the same tendency (the lower the SES, the higher the risk scores, and with the SES1 there is a negative correlation of marginal statistical significance). There is no similar pattern for gestational age.

These findings suggest that premature birth as an accident may happen in any family, regardless of SES, but at a low social level it is more likely to be associated with the baby being small-for-gestational age that involves intra-uterine complications.

The average SES scored at the children's six years of age is somewhat higher than the same measure at birth. The increase which amounts to about 2 points in both groups is primarily due to some improvement of the housing situation; besides, some parents obtained higher qualifications between the two measurement points (see Figure 1).

The Family Climate scores are somewhat higher in the families with preterm children (the difference is of marginal statistical significance, p=.054). This measure is significantly correlated with the SES in both groups, but the correlation is stronger for the full-term sample.

The Intellectual Stimulation scores are significantly higher in the preterm group ($p<.01$). It is quite likely to be related to the parents' efforts to compensate for the initial developmental delay which is quite common in prematurely born infants. The correlations between this measure and other family variables (SES, Family Climate) are high.

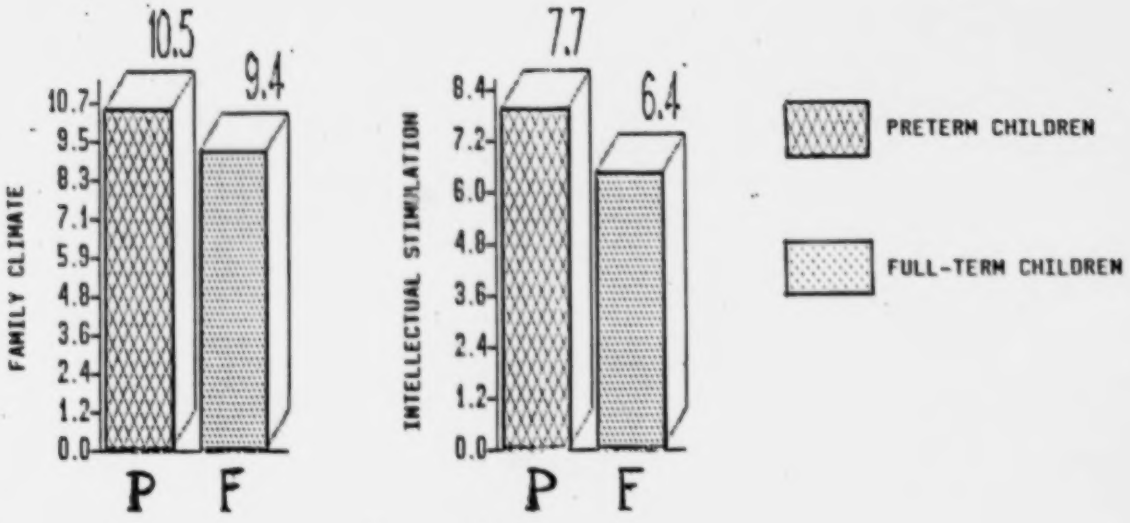

Figure 3

The breakdown of the patterns of maternal attitudes is similar for the two groups in that the great majority of mothers love their children, and as far as the other aspects are concerned, a reasonably authoritative ("quasi democratic") attitude is the most common (which again may be related to the samples having been selected on the basis of the parents' interest in participating in the project).

PATTERNS OF MATERNAL ATTITUDES

8. ACCEPTING, REASONABLY AUTHORITATIVE, "DEMOCRATIC"
7. ACCEPTING, INDULGENT, OVERPOTECTIVE
6. ACCEPTING, PERMISSIVE
5. ACCEPTING, ACHIEVEMENT-DEMANDING, PERFECTIONIST
4. REJECTING, NEGLECTING
3. REJECTING, RESTRICTIVE, AUTHORITARIAN
2. - " - (different punishment)
1. INCONSISTENT, UNPREDICTABLE, UNCONTROLLED EMOTION-GOVERNED

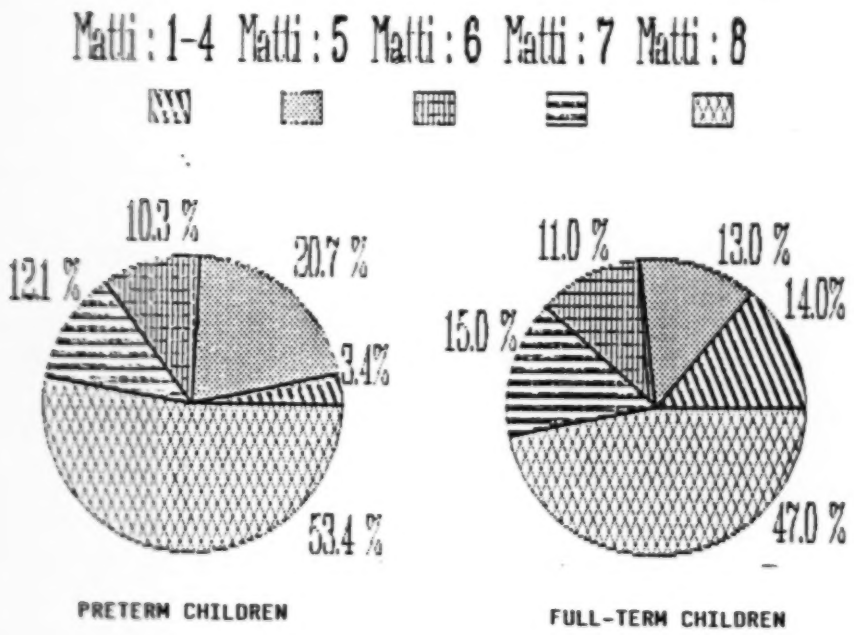

Figure 4

Typical concomitants of the different maternal attitudes

If we go into more details, however, we can find indications of important specific relationships underlying either the above globally similar breakdowns of maternal attitudes or the high intercorrelations of the family variables.

The mothers of preterms hardly ever (altogether only in two cases) reject their children, and the percentage of the accepting, democratic attitude is even more prevailing. Surprisingly, the percentage of overprotective mothers is not higher among those with preterm children, they are, however, more often demanding in respect of achievements. We may speculate that in some mother perfectionism is a reaction to the initial developmental problems of the child, thus related to the compensatory efforts. This assumption is corroborated by the high "intellectual stimulation" scores in this subgroup that is not a concomitant of the perfectionist maternal attitude in the full-term sample.

The perinatal status of the preterm baby does not seem to have a major impact on the mother's attitude after infancy. Over-permissiveness is an exception: the children of such mothers had higher birth-weights, hence presumably caused less concern as to their prospects. In the full-term sample this attitude is often associated with low SES which is not typical of the preterm sample. What these subgroups in both samples have in common is a relatively poor intellectual outcome of the children, which, in turn, may have something to do with the less-than-average intellectual stimulation provided for children of permissive mothers.

The IQs of children of "democratic" mothers are higher than average. In the full-term children it may be related to SES because the mean SES score of these families is also relatively high. It is not true, however, for the families with preterms: the mothers from high SES families tend to be rather overprotective toward their preterm children. The children of overprotective mothers often have lower-than-average IQs, although they have steadily improved with age: by 6 years the mean IQs of these subgroups reached the average level of their respective (preterm or full-term) sample.

The families with "democratic" mothers provide a great amount of intellectual stimulation for the child. In the full-term sample the average score of this subgroup is outstanding among the other maternal attitude-subgroups; in the preterm sample three subgroups have very high intellectual stimulation scores (besides the democratic, the overprotective and the perfectionist).

The families with rejecting-neglecting mothers (4 in the full-term, one in the preterm sample) have higher than average SES. It is notable that their advantage is more marked for the second SES scores. As mentioned earlier some increase of the SES scores between the two measurement points is generally typical of both samples, but it is remarkable that the gain in this subgroup is double the average. It suggests that the improvement of the socio-economical situation is likely to have priority over child rearing in the value system of these parents. The children's intelligence is varied, but their positions in the IQ rank orders of the full sample show a downward trend between 3 and 6 years of age (in the beginning the average IQ of this subgroup was slightly above the average of the full sample while at the age of 6 it is already below).

There are only a few (6) rejecting-restrictive (authoritarian) mothers, and exclusively among those with full-term children. In this small subgroup there is no clear pattern of relationships either in the other family variables or the intellectual outcome.

Unpredictable maternal behaviour, governed by uncontrolled (often negative) emotions, was very rare (4 cases in the full-term group and only 1 among the preterms) and always related to low SES. These families are struggling with major everyday problems and the mothers' readiness to participate in the study has been motivated by a need for support, not limited to child rearing questions. In this subgroup the scores for Intellectual Stimulation are much lower than average (the same is true for Family Climate but as noted earlier this measure and the maternal attitude overlap). The average IQs of the full-term children of these mothers are below the average of the total sample but their handicap has decreased between 3 and 6 years of age.

To summarize the relationship between SES and the other family variables, it is notable that for the full-term group the correlations are stronger. Although they are highly significant also for the preterm sample, in the latter case the patterns are complicated by the children's specific birth situation and perinatal status.

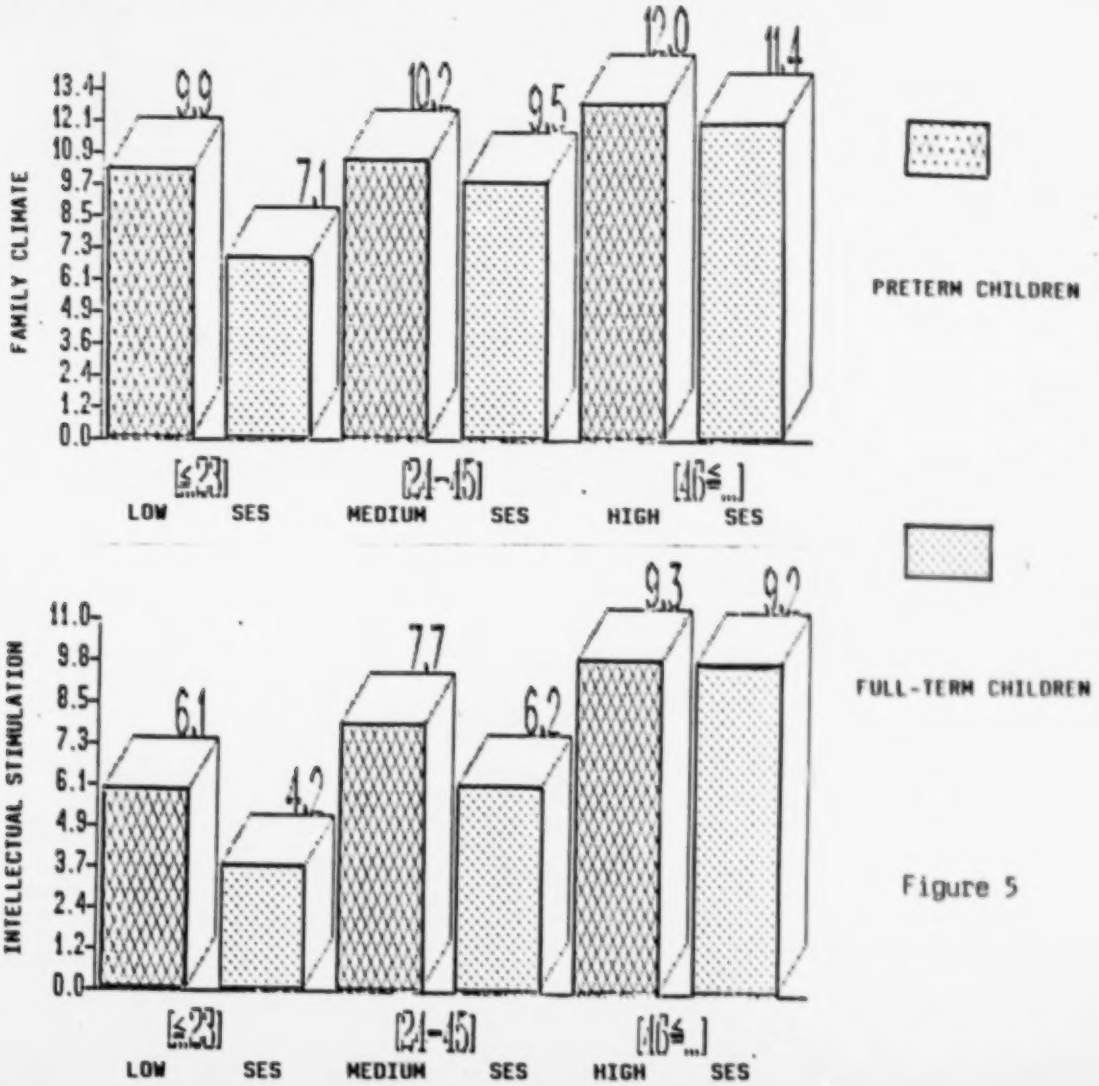

Figure 5

As mentioned earlier, both the Family Climate and the Intellectual Stimulation scores are higher for the preterm sample, but the advantage is not evenly distributed. Instead, it mainly applies to lower SES families, and this may in part account for the lower correlations between the SES and the intellectual outcome in preterm children as compared to the full-term group.

It seems worthwile having a look at the same data from a different angle: from the outcome measures, the IQs.

At the age of three our low-risk prematurely born target children as a group significantly lagged behind the full-term control group, but they have caught up by four years, and, interestingly, at five they even outperformed the control group. By the age of six, however, their advantage vanished, and both groups performed at the same level. As far as the potential contributors to mental development are concerned, the picture for the preterm group appears far more complicated.

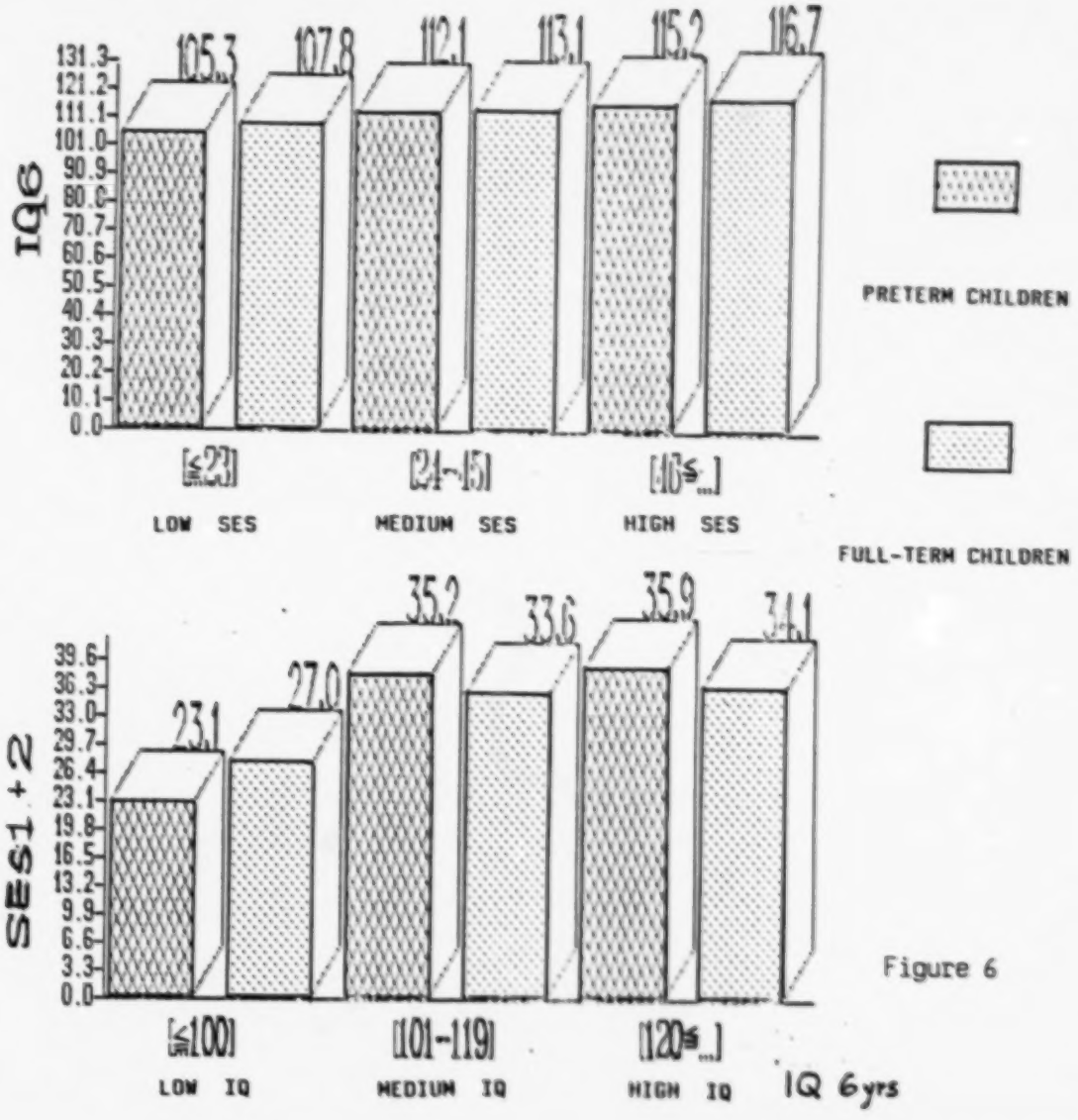

Figure 6

For the full-term children the correlations between the IQs within the age range of 3 and 6 years and the SES are all highly significant. In contrast, for the preterm group the same correlations are low at three years of age, rise to a moderate level by four and remains the same at five, to reach the 1% significance limit only by the age of 6. As the diagram shows the average SES of the preterm children who scored below 100 on the IQ test is strikingly low: it suggests that these are primarily the children with low IQ who contribute the most to this correlation.

The other variables related to the home environment seem to have captured processes that more directly influence the intellectual outcome than SES.

All of the correlations between the IQs (except the preterms' 3-year IQ) and the Family Climate scores are significant, and they are all higher than the respective IQ-SES correlations.

The amount of Intellectual Stimulation has proved to be the most powerful measure to predict intellectual development. With one exception (the full-term sample at the age of 6) always this variable has the strongest correlations with the IQs.

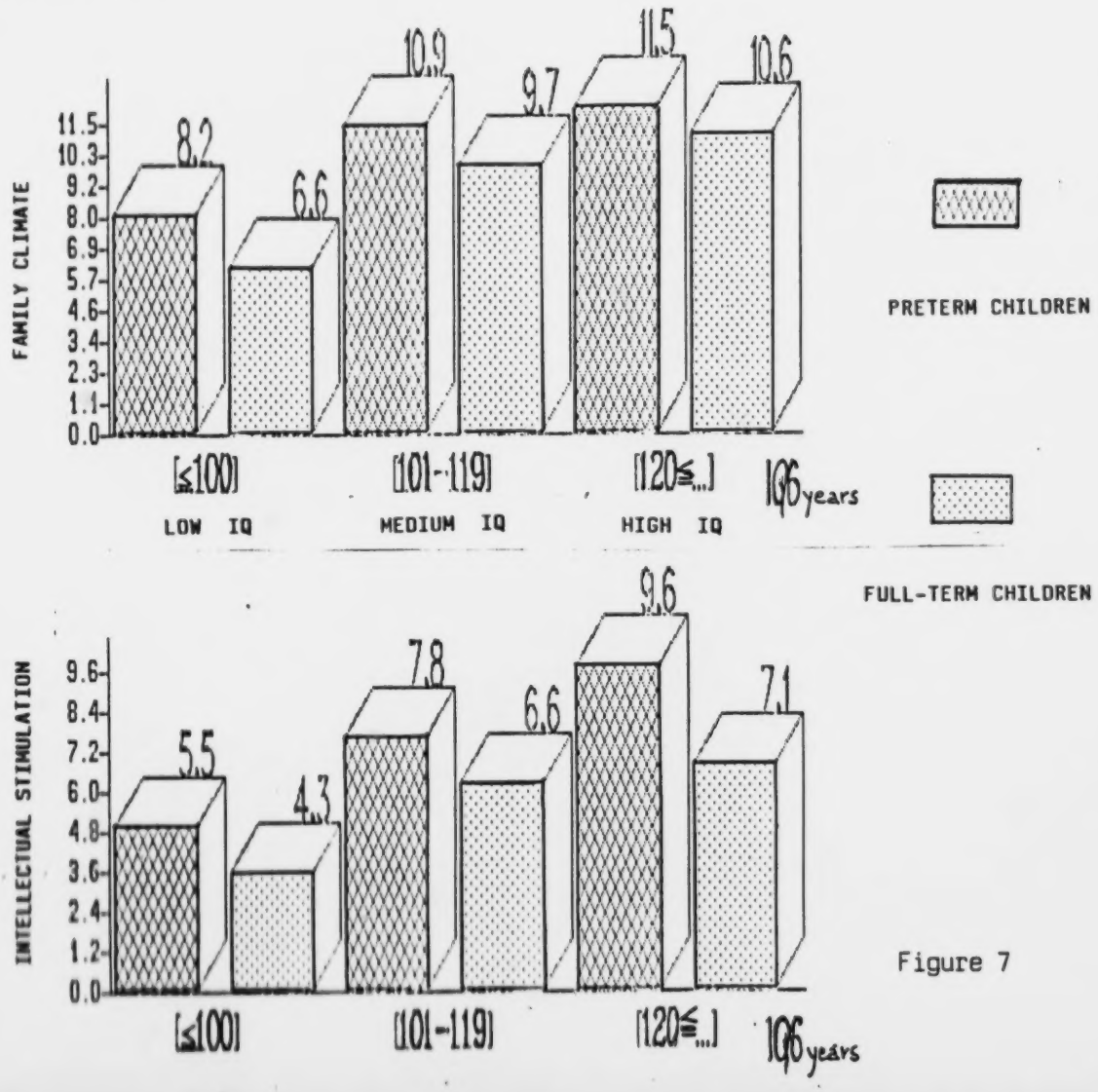

Figure 7

In an attempt to clarify the relationships between the intellectual outcome and the predictor variables a stepwise multiple regression analysis was performed (criteria for inclusion = 0.05).

For the preterm group at three years of age, no variable met criteria for inclusion. At four, as mentioned earlier, "Intellectual Stimulation" had the strongest correlation with IQ. With this effect partialled out, two of the biological variables remained significant (Gestational Age and Birth Weight). Two variables were retained in the equation: Intellectual Stimulation and Gestational Age (Multiple R=0.51). From the age of five the effect of the perinatal biological factors cannot be detected any more, and in the regression equations for five and six years only the Intellectual Stimulation was retained (R=0.47; R=0.48). For the full-term sample the variables retained in the regression equation are the following: at the age of three "Intellectual Stimulation", at four the same plus "Family Climate", at five "Intellectual Stimulation" again, and at six "Family Climate" alone (R= 0.43, 0.47, 0.42, 0.40, respectively).

The role of the Intellectual Stimulation can be well demonstrated by cases in which the expected relationship between the SES and another home variable, for example, the particular maternal attitude fails to exist.

In the preterm sample neither the families with democratic mothers nor those with perfectionist mothers have mean SES scores higher than average yet their children have high IQs; the Intellectual Stimulation scores in both subgroups are very high. Also among the preterm children the subgroup with over-permissive mothers have an average level of SES but the mean IQ of these children is relatively low. The amount of Intellectual Stimulation they are provided with is little. Similarly, the full-term children with neglecting mothers come from high SES families which do not provide much intellectual stimulation; their mean IQ is below average.

In this respect only the preterm children of overprotective mothers do not seem to fit the general pattern. In this case both the SES and the Intellectual Stimulation scores are high, but up until 5 years the IQs are below average. In the full-term group the same maternal attitude is associated also with less than average intellectual stimulation, and the children's IQs are always below average. Overprotectiveness seems to counteract mental growth, at least in early childhood, as it should be noted that the IQs of these children show a steady upward trend with age.

CONCLUSION

Our data have provided further evidence that perinatal risk conditions, such as preterm birth, may have a differential impact on mental development, depending upon social-environmental factors (Kopp & McCall, 1982). Advantaged family circumstances may reduce or even fully compensate for the adverse effects of perinatal risks, while a disadvantaged enviroment is likely to amplify these. Therefore, as our findings, in line with those reported by Siegel (1982) suggest, the impact of environmental processes may be accentuated in preterm children as compared to their non-risk full-term peers.

The "main-effect" models of development (or, as Reese and Overton, 1970, refer to it, a linear-mechanistic approach) are clearly not adequate to explain the complex interplay of factors contributing to the developmental outcome of children born at medical risk; but even a model as dynamic as Lewis' interactional model (Lewis, 1972; Lewis & Fox, 1980) does not seem to be able to account for the diversity of individual variations. Not only the outcome of any environmental effect is a function of the state of the individual, but the latter plays an active role in its own development as well in that it influences the caregivers' behaviour by its individual characteristics from the very beginning. Therefore, for understanding the developmental mechanisms shaping the outcome in preterm children, Sameroff's transactional model (Sameroff & Chandler, 1875; Sameroff, 1979, 1982) and Belsky's (1984) ecological parenting process model might serve as appropriate theoretical framework.

The specific behavioural patterns of preterm babies that influence caregiver-infant interactions, and, consequently, the parental behavioural patterns toward these infants have been extensively documented and discussed (Als & Brazelton, 1981; Brown & Bakeman, 1980; DiVitto & Goldberg, 1979; Field, 1979; Goldberg, 1979; Klaus & Kennell, 1970; Leifer et al, 1972, Minde et al, 1983, 1986). Very often the specific parental behaviours are motivated by a compensatory effort. There is some indication in our data that a certain specificity of the parent's behaviour toward prematurely born children may persist well into middle childhood. The majority of mothers with preterm children who participate in our project appear to have adjusted their behaviour quite succesfully to the particular needs of their "at risk" children. It is very likely that these mothers play a crucial part in the intellectual outcome of the preterm group that is perfectly comparable with that of a sample of non-risk full-term children with similar socioeconomic background.

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